Chapter 7. Date/Time Format

PDS has adopted a subset of the International Standards Organization Standard (ISO/DIS) 8601 standard entitled “Data Element and Interchange Formats - Representations of Dates and Times”, and applies the standard across all disciplines in order to give the system generality. See also Dates and Times in *Object Description Language* (Chapter 12, Section 12.3.2) of this document.

It is important to note that the ISO/DIS 8601 standard covers only ASCII representations of dates and times.

7.1 Date/Times

In the PDS there are two recognized date/time formats:

CCYY-MM-DDTHH:MM:SS.sssZ (preferred format)
CCYY-DDDTHH:MM:SS.sssZ

Each format represents a concatenation of the conventional date and time expressions with the two parts separated by the letter T:

CC	-	century (00-99)
YY	-	year (00-99)
MM	-	month (01-12)
DD	-	day of month (01-31)
DDD	-	day of year (001-366)
T	-	date/time separator
HH	-	hour (00-23)
MM	-	minute (00-59)
SS	-	second (00-59)
sss	-	fractions of second (000-999)

The time part of the expression represents time in Universal Time Coordinated (UTC), hence the Z at the end of the expression (see Section 7.3.1 for further discussion). Note that in both the PDS catalog files and data product labels the “Z” is optional and is assumed.

PDS standard date/time format, i.e., the preferred date/time format, is: CCYY-MM-DDTHH:MM:SS.sssZ.

Date/Time Precision

The above date/time formats may be truncated on the right to match the precision of the date/time value in any of the following forms:

1998
1998-12
1998-12-01
1998-12-01T23
1998-12-01T23:59
1998-12-01T23:59:58
1998-12-01T23:59:58.1

ODL Date/Time Information

Chapter 12, *Object Description Language (ODL) Specification and Usage*, Section 12.3.2, **Dates and Times**, of this document provides additional information on the use of ODL in date/time formation, representation, and implementation.

7.2 Dates

The PDS allows dates to be expressed in conventional and native (alternate) formats.

7.2.1 Conventional Dates

Conventional dates are represented in ISO/DIS 8601 format as either year (including century), month, day-of-month (CCYY-MM-DD), or as year, day-of-year (CCYY-DDD). The hyphen character ('-') is used as the field separator in this format. The former is the preferred format for use in PDS labels and catalog files and is referred to as *PDS standard date format*, but either format is acceptable.

7.2.2 Native Dates

Dates in any format other than the ISO/DIS 8601 format described above are considered to be in a format native to the specific data set, thus "native dates". Native date formats are specified by the data preparer in conjunction with the PDS data engineer. Mission-elapsed days and time-to-encounter are both examples of native dates.

7.3 Times

The PDS allows times to be expressed in conventional and native (alternate) formats.

7.3.1 Conventional Times

Conventional times are represented as hours, minutes, and seconds using the full ISO/DIS 8601 format: HH:MM:SS.sss. Note that the hours, minutes, and integral seconds fields must contain two digits. The colon character (':') is used as a field separator. The seconds field may include a fractional part if appropriate; if so, a period is used as the decimal point (the European-style comma may not be used). The fractional part may not exceed 3 digits (thousandths of a second).

The PDS has adopted the use of Universal Time Coordinated (UTC) for expressing time, using the format HH:MM:SS.sssZ. Note that in both the PDS catalog files and data product labels the “Z” is optional and is assumed. Fractions of seconds cannot exceed a precision of milliseconds. This format is hereafter referred to as *PDS standard time format*.

The START_TIME and STOP_TIME data elements required in data product labels and catalog templates use the UTC format. For data collected by spacecraft-mounted instruments, the date/time must be a time that corresponds to “spacecraft event time”. For data collected by instruments not located on a spacecraft, this time shall be an earth-based event time value.

Adoption of UTC (rather than spacecraft-clock-count, for example) as the standard facilitates comparison of data from a particular spacecraft or ground-based facility with data from other sources.

7.3.2 Native Times

Times in any format other than the ISO/DIS 8601 format described above are considered to be in a format native to the data set, and thus “native times”. The NATIVE_START_TIME and NATIVE_STOP_TIME elements hold the native time equivalents of the UTC values in START_TIME and STOP_TIME, respectively.

There is one native time of particular interest, however, which has specific keywords associated with it. The spacecraft clock reading (that is, the “count”) often provides the essential timing information for a space-based observation. Therefore, the elements SPACECRAFT_CLOCK_START_COUNT and SPACECRAFT_CLOCK_STOP_COUNT are required in labels describing space-based data. This value is formatted as a string to preserve precision.

Note that in rare cases in which there is more than one native time relevant to an observation, the data preparer should consult a PDS data engineer for assistance in selecting the appropriate PDS elements.

The following paragraphs describe typical examples of native time formats.

1. **Spacecraft Clock Count (sclk)** - Spacecraft clock count (sclk) provides a more precise time representation than event time for instrument-generated data sets, and so may be desirable as an additional time field. In a typical instance, a range of spacecraft-clock-count values (i.e., a start-and a stop-value) may be required.

   Spacecraft clock count (SPACECRAFT_CLOCK_START_COUNT and SPACECRAFT_CLOCK_STOP_COUNT) shall be represented as a right-justified character string field with a maximum length of thirty characters. This format will accommodate the extra decimal point appearing in these data for certain spacecraft and other special formats, while also supporting the need for simple comparison (e.g., “>” or <”) between clock count values.

   Note that if the spacecraft clock values are not strictly numeric strings (for example, if they contain colon separators), care should be taken in dealing with blank padding and justification of the string value. If necessary, non-numeric strings may be left-justified to ensure that clock values will sort in the expected way.

Example

```
SPACECRAFT_CLOCK_START_COUNT = " 1234:36.401"        correct
SPACECRAFT_CLOCK_START_COUNT = "1234:36.401 "        incorrect
```

2. **Longitude of Sun** - Longitude of Sun (“L_S”) is a derived data value that can be computed, for a given target, from UTC.

3. **Ephemeris Time** - Ephemeris time (ET) is calculated as “TAI + 32.184 sec. + periodic terms”. The NAIF S and P kernels have data that are in ET, but the user (via NAIF ephemeris readers which perform data conversion) can obtain the UTC values.

4. **Relative Time** - In addition to event times, certain “relative time” fields will be needed to represent data times or elapsed times. Time-from-closest-approach is an example of such a data element. These times shall be presented in a (D,H,M,S) format as a floating point number, and should include fractional seconds when necessary. The inclusion of “day” in relative times is motivated by the possible multi-day length of some delta times, as could occur, for example, in the case of the several-month Galileo Jupiter orbit.

5. **Local Times** - For a given celestial body, LOCAL_TIME is the hour relative to midnight in units of 1/24th the length of the solar day for the body.

6. **Alternate Time Zones (Relative to UTC)** - When times must be expressed according to an alternate time zone, they shall consist of hours, minutes, seconds, and an offset, in the form HH:MM:SS.sss+n, where n is the number of hours from UTC.